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## Newsletter

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### Volume 3, Issue 1

<http://ffc.arc.nasa.gov>

*January 2003*

### TABLE OF CONTENTS

1. [\*\*Preparing the Dallas/Fort Worth International Airport Perimeter Taxiway Demonstration\*\*](#)  
FutureFlight's extensive preparations make for a realistic emulation of air traffic control tower operations.
  2. [\*\*Waiting in the Wings: KSC Training Simulation\*\*](#)  
In May, air traffic controllers from the Kennedy Space Center's Shuttle Landing Facility will train for the convoy command operation that services the Space Shuttle upon landing.
  3. [\*\*Conceptualizing the Future: More Efficient Operations with New Aircraft\*\*](#)  
NASA's Aeronautical Projects and Program Office and FutureFlight Central recently completed an airport simulation, using a prototype Extreme Short Take-Off and Landing (ESTOL) aircraft.
  4. [\*\*Expanding Connections: FutureFlight and the Vertical Motion Simulator\*\*](#)  
Real-time connectivity between three simulation facilities will demonstrate simultaneous operations of FutureFlight Central, the Crew Vehicle Systems Research Facility (B747-400 cockpit simulator) and the Vertical Motion Simulator.
  5. [\*\*New Projectors Improve Visualization\*\*](#)  
FutureFlight installs new video projectors to enhance the fidelity of its out-of-the-window visual scene.
  6. [\*\*Upcoming Events & Conferences\*\*](#)
  7. [\*\*Thinking of Doing Business With FutureFlight Central?\*\*](#)
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### 1. Preparing the Dallas/Fort Worth International Airport Perimeter Taxiway Demonstration

When Abraham Lincoln said, "Give me six hours to chop down a tree and I will spend the first four sharpening the axe," he could be describing preparations prior to running a simulation.

In February 2003, Dallas/Fort Worth International Airport (DFW) will demonstrate its proposed perimeter taxiway system using the combined tower and flight simulation capabilities of FutureFlight

Central (FFC) and the Crew Vehicle Systems Research Facility (CVSRF), located at the NASA Ames Research Center. (You can view a map of the proposed airport configuration in the [October](#) newsletter.) In collaboration with NASA, the FAA William J. Hughes Technical Center Simulation and Analysis Group is providing the simulation design, data analysis, and technical report.

What are some of the detailed, behind-the-scenes preparations that FutureFlight will make for the Dallas/Fort Worth Airport Perimeter Taxiway (DAPT) Demonstration?

Preparation for such a project begins with the preparation of the 3-D out-of-the-window depiction of the airport under study. DFW is one of the biggest airfields in the world, encompassing 18,000 acres and operating seven runways, with an eighth in the works. The DAPT Demonstration made use of the already created DFW 3-D model, a cost-saving benefit. FutureFlight only needed to modify the airport model by adding the proposed perimeter taxiways.

FutureFlight also prepared a 2-D map, used for representing surface radar. Pseudo-pilots, who “fly” the virtual airplanes, use the 2-D map to move the aircraft. In preparation for the pseudo-pilots' use, each ground route an aircraft might take is meticulously hand entered into the simulator's database.



*Pseudo-pilots at work*

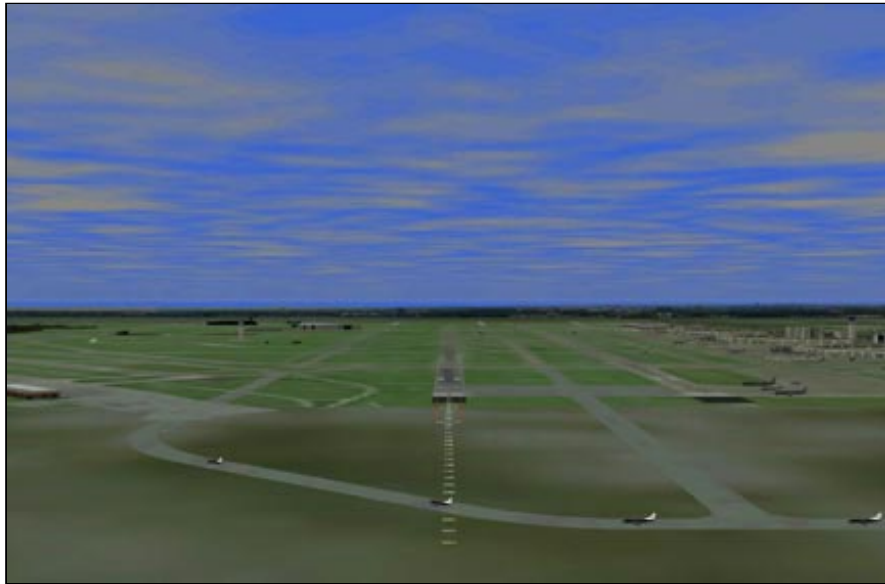
Pseudo-pilots must be trained. For every project it runs, FutureFlight brings in former air traffic controllers, pilots, or aviation students who must respond as if they were in fact pilots. For the DAPT Demonstration, pseudo-pilots will control the virtual aircraft under the direction of certified DFW controllers; their immediate, spoken response requires knowledge of the airport and standard phraseology. FutureFlight will spend several weeks preparing pseudo-pilots for the DAPT Demonstration.

The DAPT Demonstration will break new ground for two Ames simulation facilities: for the first time, FutureFlight and the CVSRF will be connected in real-time. The facilities aligned their visual databases so that aircraft would appear at the exact same location in both the tower and the cockpit visual systems. In the FutureFlight tower, a controller will be in contact with the pilot flying the B747-400, which will appear as one of the aircraft in the out-of-the-window tower visual scene. On the CVSRF side, aircraft also flying into and out of DFW will appear in the pilot's screens.

As for any research project, we will collect data. We prepare in advance to collect the data needed to support the goals of the demonstration. For DFW, we will collect video and audio recordings, input from controllers and pilots, and statistical data related to the proposed airport improvements.

The final result? The demonstration will give commercial pilots and FAA controllers the opportunity to experience perimeter taxiways within the realistic working environment of both the B747-400 cockpit and the control tower simulators. Pilot and controller observations regarding safety, efficiency, and communication will help evaluate the operational issues of the new taxiway system.

DFW, among the world's busiest airports, will be the first international airport to participate in such a detailed demonstration of a proposed perimeter taxiway system. The four-day demonstration, the months of preparation, and the real-time data that will result will benefit both DFW and the industry for years to come.



*B747-400 flight simulator view of a final approach with aircraft taxiing on the proposed DFW perimeter taxiways.*

## 2. Waiting in the Wings: KSC Training Simulation

In May, air traffic controllers from the Kennedy Space Center's Shuttle Landing Facility will train for the convoy command, emergency procedures, and security operations that support the Space Shuttle on landing and launch.

KSC will be returning to FutureFlight Central to rehearse typical and emergency preparedness procedures. FutureFlight's very realistic out-of-the-window views of the Shuttle Landing Facility make it an ideal training environment. Previously, KSC used the facility to validate its choice of a new tower location and interior cab arrangement.



*FutureFlight's model of the shuttle orbiter surrounded by convoy vehicles*

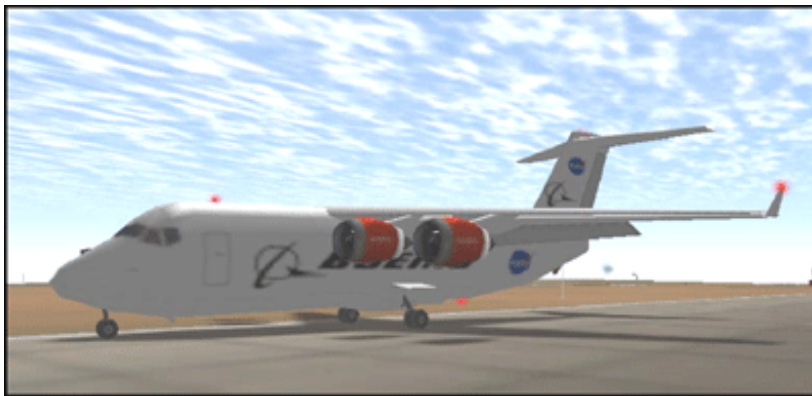
Shuttle orbiter landings happen approximately six to eight times a year. However, with virtual training, the shuttle orbiter landings can be repeated many times. Communications coordination among air traffic controllers, convoy commanders, and emergency personnel can also be practiced. Trainers can stop, discuss an event, suggest improvements, and replay the training simulation in order to perfect air traffic controllers' responses.

KSC expects to enhance the safety of shuttle orbiter landings. Thanks to training in the virtual environment, controllers will practice even before the new tower becomes operational. The new tower is expected to open in August 2003.

### 3. Conceptualizing the Future: More Efficient Operations with New Aircraft

Consider this: Today, if you live an hour or two distant from a hub airport, it may be faster to drive than to fly to your destination less than 300 miles away. However, a new system under investigation could make air transportation more flexible and efficient, especially for the regional traveler.

NASA's Aeronautical Projects and Program Office and FutureFlight Central recently completed an airport simulation, using a prototype Extreme Short Take-Off and Landing (ESTOL) aircraft. Simultaneous Non-Interfering (SNI) approaches formed a key aspect of this new aircraft's operation. Such operations would use descending, decelerating, curved approaches and ascending, accelerating, curved departures.



*Image of the ESTOL aircraft designed by the students at the Cal Poly (San Luis Obispo) Design Lab under the direction of NASA's Aeronautical Projects and Programs Office.*

An ESTOL type aircraft, operating within an SNI profile, could form the basis for a new system, which takes advantage of under-utilized airport facilities, such as hub cargo areas or regional airports, by using runways shorter than 3,000 feet. (The typical commercial runway averages between 8,000 -12,000 feet, the size necessary to accommodate large jets.) At hub airports, SNI approaches could maximize existing airspace by adding aircraft into the system, without adding system delays.

At FutureFlight, the simulation engineers dynamically modeled approaches and departures within a realistic hub environment, showing the operational possibilities. Using digital footage of the simulation, a short video was developed and shown as part of a keynote presentation at the recent International Powered-Lift Conference.

How many runways exist for an ESTOL system? The map pictured below gives a compelling national look at the potential advantages: many runways shorter than 8,000 feet exist. In California alone, there are at least 50 runways that could be used without modification. ESTOL aircraft and airport operations could reduce the airport delays as well as increasing the mobility of the traveling public.





*Availability of Runways in the United States; map courtesy of the Aeronautical Projects and Programs Office, NASA Ames Research Center*

#### 4. Expanding Connections: FutureFlight and the Vertical Motion Simulator

In April, real-time connectivity between three facilities, FutureFlight, the Crew Vehicle Systems Research Facility (B747-400 cockpit simulator), and the Vertical Motion Simulator will be demonstrated. This is the third in a series of tests, demonstrating the linkage between three of the NASA Ames Research Center simulators. (In the [October](#) newsletter, we described the Crew Vehicle Systems Research Facility.)

Do new vehicles present new air traffic control challenges? Simulations with the Vertical Motion Simulator (VMS), the CVSRF, and FutureFlight Central might tell us. With connectivity, revolutionary airspace technologies can be rigorously tested on the users most affected: the pilots and the air traffic controllers

What is the VMS? The VMS is the largest motion-based simulator in the world, featuring six degrees of freedom, meaning that the cab, with the pilot inside, can be driven in any of the six ways an aircraft moves. This includes the three translations: vertical, lateral, and longitudinal and the three rotations: pitch, roll, and yaw. It has a 60-foot vertical and 40-foot lateral motion capability.

Two VMS capabilities stand out: the ability to customize the system to simulate any aerospace vehicle and the ability to provide simulations of great fidelity, emulating the flight characteristics of a given aircraft. This entails delivering realistic cues to the pilot in real time, so the pilot perceives that the simulated aircraft responds just as quickly as a real aircraft. This makes the VMS ideal as a research simulator as well as a training simulator.

For example, every nine months the VMS simulates the Space Shuttle Orbiter. Last year simulations included four weeks of training for upcoming mission crews. Various system failures were introduced as well as the latest upgrades to the Heads-Down Displays (HDD).



*One of the five VMS interchangeable cabs, ready for its simulation*

Another simulation last year was conducted for the National Transportation Safety Board (NTSB) in order to determine if the VMS could provide the needed fidelity to meet future NTSB accident investigation requirements. The VMS met all of the NTSB's requirements.

In the upcoming year, the VMS is scheduled to run simulations supporting the Joint Strike Fighter (JSF) Program, continuing accident investigations for the NTSB, and some potential helicopter research in support of the Army.

More information about the VMS can be found at <http://www.simlabs.arc.nasa.gov/vms/vms.html>

## 5. New Projectors Improve Visualization

FutureFlight opened for business in 1999. Its hallmark has been a highly realistic reproduction of the controllers' out-of-the-window view. In order to maintain its optimum capabilities, FutureFlight periodically updates its infrastructure.

This January, FutureFlight installed twelve new video projectors, whose behind-the-scenes-work attracts far less attention than other more visible features in the facility. Nevertheless, they are essential components, displaying the out-of-the-window tower cab scene of the airport and its traffic.

Since the tower air traffic controllers' job entails maintaining safe separation of aircraft on the ground, a significant portion of their task is visual. FutureFlight's new video projectors will present a virtual world of high-resolution images with natural and accurate colors, comparable to film and the real world. Thanks to a high contrast ratio, images will be sharp and crisp with enhanced depth and superior clarity, especially important for reproducing night scenes.

In addition, a high contrast ratio helps the controllers to detect subtle differences in the visual scene. The new projectors will project a scene that is uniform both in its brightness and color within each screen and from one screen to another. This capability will help controllers in maintaining visual contact with the aircraft as it moves throughout FutureFlight's twelve-screen display.



*A cutaway view of the FutureFlight Central Tower Cab showing the projectors behind the screens.*

The technology for the new projectors features a high-density, reflective liquid crystal structure; it belongs to the generic class of liquid crystal on silicon (LCOS) technology.

## 6. Upcoming Events & Conferences

NASA FutureFlight Central will be participating in the following event:

AAAE/ACC Airport Planning, Design, and Construction Symposium,  
February 19 - 21, 2003, Denver, Colorado.

More information about the conference can be found at  
<http://www.airportnet.org/depts/meetings/regforms/0202bro.pdf>

► [Acrobat Reader](#) -- download this program to view the PDF form

## 7. Thinking of Doing Business with FutureFlight Central?

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for more information and to explore what we can do for your needs.

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The Team at NASA FutureFlight Central <http://ffc.arc.nasa.gov>

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